Venous Anastomoses for Dialysis Access : Special Techniques with the Use of E-PTFE Vascular Prosthesis at the Forearm

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Venous Anastomoses for Dialysis Access—Special Techniques with the Use of E-PTFE Vascular Prosthesis at the Forearm

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SUMMARY

Suitable veins of great diameter should not be the limitation for the use of E-PTFE prosthesis as a vascular access of second choice for chronic hemodialysis. A sufficient venous drainage has to be attempted inspite of possibly generally bad state of veins regarding the need for retrograde use of vessels. This can be achieved in such cases by careful vascular surgical technique performing multiple-anastomosis or establishing multiple-drainage. By the application of these rules vessels that would otherwise remain unused can be utilized for vascular access in chronic hemodialysis patients. Thus even few months of function after these procedures can be regarded as a success.

INTRODUCTION

In chronic hemodialysis Teflon vascular prostheses have been established as a vascular access of the second choice. For this purpose they are generally applied with a diameter of 6 to 8 millimetres [1,2,4,5]. The best results are obtained, when the venous portion of the prosthesis is connected with an appropriate vein of equal calibre. This should be done end-to-side over a long distance. However, often there is no adequate vein of similar gauge. On the other hand the diameter of the outflow vein should be more than 3 millimetres as otherwise recirculation and thrombosis may be the consequence of the small flow velocity. With regard to the absolute necessity of vascular access even if there are only small gauged veins it seems logical to achieve sufficient blood flow by the addition of two or more of such small veins.

TECHNIQUES OF OPERATION

TYPE A ANASTOMOSIS: The use of a venous branching represents the easiest way to raise the flow volume within the prosthesis. The vascular anastomosis has to be constructed over a long distance. Thus the blood can be drained in all veins (Fig. 1.). At the beginning blood outflow will

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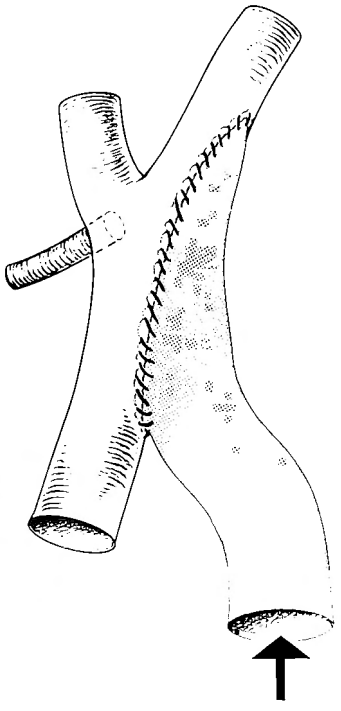

Fig. 1. *TYPE A ANASTOMOSIS*: Venous anastomsis of a so called Teflon-dialysis fistula over a long distance in the are of a venous branching. Thus an easy drainage of blood into all single venous branches is made possible.

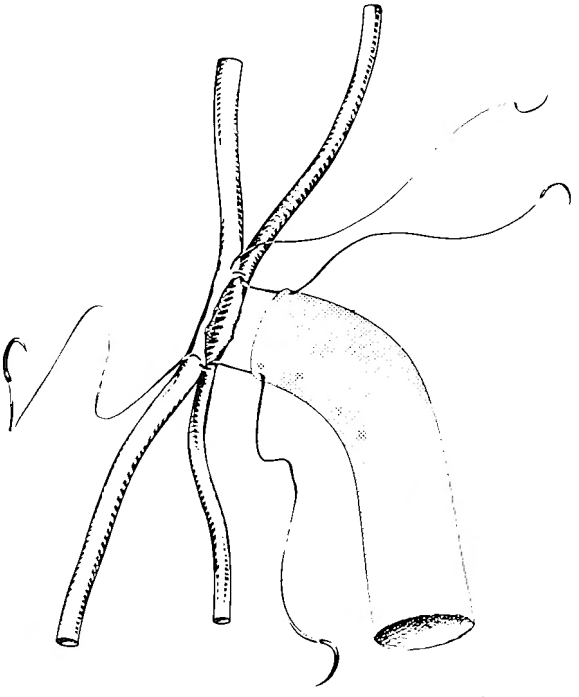

Fig. 2. *TYPE B ANASTOMOSIS*: Two parallel and thin gauged veins are first sutured in the posterior part Only with pursestring 7*0 Prolene suture. Then an end-to-side anastomosis is built between the venous part of the Teflon-dialysis-fistula and the combined veins.

move preferably into the proximal direction. As could be shown by radiography the venous valves in the perforator veins and the distal veins become secondarily insufficient and blood is additionally drained by these veins.

TYPE B ANASTOMOSIS: If there are two veins of small calibre running togehter (i.e. a doubled *vena basilica* or *vena cephalica*) we can successfully perform the technique described in Fig. 2. The operation site is shown in Fig. 3. A long distance side-to-side anastomosis is performed between both veins. Only the posterior walls are sutured. Thus a large lumen between the anterior walls is created and has to be anastomosed with the Teflon prosthesis.

TYPE C1 ANASTOMOSIS: If the veins are too far apart fo anastomosis we perform the double or multiple anastomosis. This is shown schematically in Fig. 4. The two venous anastomoses are shown in Fig 5a and 5b (site of operation) Only superficial veins are used in this type of anastomosis.

TYPE C2 ANASTOMOSIS: Here we also use deep veins (i.e. branches of the branchial vein) in combination with superficial veins, mostly in the elbow region (See Fig.6).

Fig. 3. *TYPE B ANASTOMOSIS* : Sight of operation after the suture of the posterior vessel walls and first stitch of Teflon prosthesis with the newly created double sized lumen.

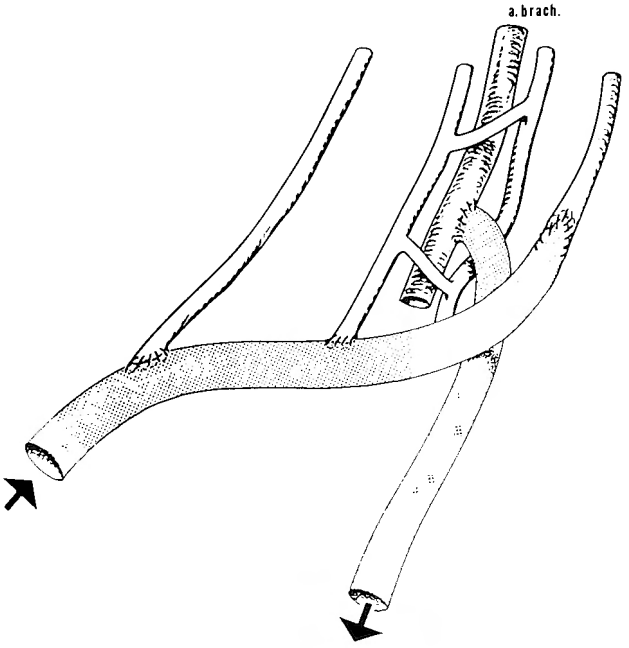

Fig. 4c. *TYPE C1 ANASTOMOSIS*: Schematic drawing of a "triple-anastomosis" between the venous portion of the "Teflon-dialysis-fistula" and cephalic vein, basilic vein and one branch of brachial vein.

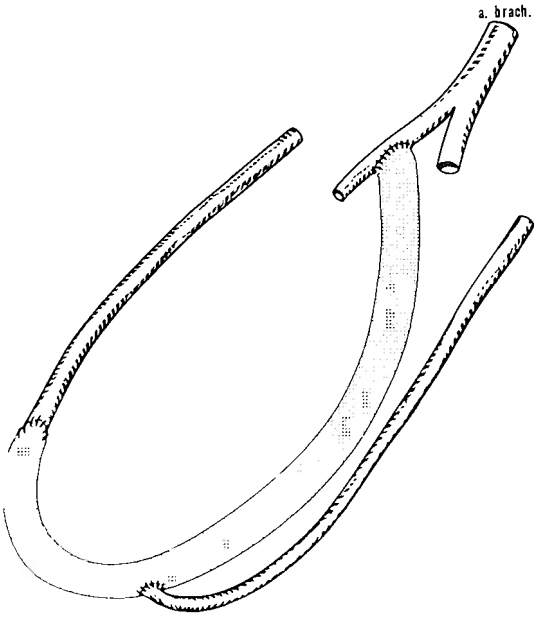

Fig. 5. *TYPE C2 ANASTOMOSIS*: Schematic drawing: the venous portion of the "Teflon-dialysis-fistula" is anastomosed twice in the periphery with cephalic vein and basilic vein.

Fig. 4a and 4b. *TYPE C2 ANASTOMOSIS*: Operation views demonstrating the double anastomosis of the Teflon-dialysis-fistula in the perphery with cephalic vein and basilic vein.

RESULTS

We performed 21 Type A anastomoses up to now. There were three failures of function not related to the sugical procedure. In 11 cases we noticed thrombosis after 3, 4, 6, 6, 6, 6, 7, 11, 11, 13 and 14 months postoperatively. The function was restored by simple thrombectomy in two cases, by bougienage of the draining vein in four cases and by a new anastomosis in a more proximal location in two cases (Teflon-interposition). Three prostheses remained without function.The remaining to Teflon prostheses are in function for 2–29 months. As an unexepected result we found in 3 of the revised and in 4 of the non-revised cases the venous drainage following only one single venous branch. In 4 of these cases drainage is done along the vein with the distal direction.

There were 9 operations of type B anastomosis. Besides one loss of function not related to anastomotic technique we noticed another early thrombosis that could not be repaired. In two cases we had to remove thrombosis after 7 and 10 months combined with bougienage of the draining vein. 5 other prostheses have been in good function for 6, 8, 8, 10, and 11 months without problems.

TYPE *C1* anastomosis could be applied to 14 patients up to now. In one patient we had to construct the connection to the second vein by interposition of another Teflon prosthesis. In two cases of early thrombosis we could not find the rason for the occlusion during thromobectomy. One patient refused revision of thrombosis three months after the first operation. 5 revisions were done after 7, 7, 8, 10 and 12 months (two times as a bougienage and three times with new anastomosis at a more proximal site with Teflon interposition). One bougienage and one reanastomosis were done without success. 6 Teflon prostheses have been in good function for 6 to 14 months now.

TYPE *C2* anastomosis was performed in only 5 patients up to now. This procedure is chosen only if the veins are not suitable for Cimino fistulae. Thus they are of very small calibre only and are often damaged by multiple punctures already. Revision by operation had to be done in 4 cases after one months and in 3 cases after four months using a new anastomosis at a more proximal site (two times double anastomosis, two times simple anastomosis). One Teflon prosthesis is working without complicaton for 18 months now.

DISCUSSION

Vascular access for chronic hemodialysis is still perfomed with the maxim: *peripheral anastomosis before central anastomosis.* This principle is followed by the subordinate maxim: *autologous techniques before alloplastic materials.* The consequence for the practical application at the beginning of dialysis therapy is that first all possibilities of autologous in situ vascular access-techniques (Cimino fistula, venous doubling [3]) have to be utilized. If all these facilities are used up the possiblities of Teflon prosthesis in the same region (forearm) should be tried out. This seems to be especially reasonable as there are still some suitable veins for drainage more proximally at the forearm to be found. This possibility is lost when the autologous vascular access is performed at the upper arm in the first attempt already. On the other hand we apply the Teflon loop at the forearm in such a way that an autologous in-situ-fistula at the upper arm is not made impossible later on. Therefore the Teflon loop should not exceed the elbow.

As should be demonstrated in this study the above mentioned prodecure is not restricted to the presence of veins with large calibres only. The diameters of all of the here described veins conected

with Teflon prostheses were under 3 mm. The function time is therefore worse than in cases with normally gauged veins. Especially in patients with only "poorly shuntable" vessels any chance of anastomosis has to be utilized with careful vascular technique. Thus the situation of a so called "last vessel" should be prevented. Even comparatively short functioning times like only few months with vessels which otherwise would remain unused will then be a great success for the patient.

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